

EXHIBIT 6-F MODIFICATIONS TO CRASH TESTED BRIDGE RAILING

Elisa Valdez - Bridge Rail Memorandum regarding NCHRP 350 requirements

Page 1

Memorandum

U.S. Department
of Transportation
**Federal Highway
Administration**

Subject: **INFORMATION:** Bridge Rail Analysis

Date: May 16, 2000

Original signed by
From: Frederick G. Wright, Jr.
Program Manager, Safety

Reply to: HSA-1

To: Resource Center Directors
Division Administrators

Since 1986, the Federal Highway Administration has required all new bridge railings installed on the National Highway System to be crash tested or to be essentially the same as a railing that was tested. Since many States and municipalities in particular often desire not only architectural or aesthetic enhancements to existing acceptable bridge rails but often request acceptance of untested designs, strict compliance with this requirement could result in full scale testing of scores of essentially similar designs, increased project costs, and significant delays in construction. The AASHTO LRFD Bridge Specifications contain a procedure for analyzing certain types of bridge railings for structural adequacy and provide guidelines for desirable post and beam geometry based on the dimensions of railings that have been successfully crash tested in the past. However, a static analysis of **untested** designs has not been acceptable as an alternative to crash test verification of railing performance.

The Colorado Department of Transportation (CDOT) essentially combined both approaches by analyzing the capacity of a fully crash-tested railing and comparing the results to a similar Colorado design. The original Colorado design was then modified and re-analyzed to show that it equaled or exceeded the capacity of the tested rail. The FHWA accepted the modified Colorado design for use on the National Highway System based on the State's analysis, a copy of which has been added, along with this memorandum, to FHWA's Report 350 Hardware web site under "Bridge Railings." Specific questions on the Colorado analysis procedure may be addressed to Mr. Michael McMullen, CDOT, at (303) 757-9587 or via e-mail at michael.mcmullen@dot.state.co.us.

The FHWA bridge engineers may use this type of analysis as a basis for acceptance of bridge railings that are similar to a design that has been tested under the National Cooperative Highway Research Program (NCHRP) Report 350 guidelines. It is critical to note that this is not a "cookbook" approach, but rather one that requires careful analysis of all possible failure modes and assumed behavior of all rail elements and connection details. The failure modes may differ from those identified in the Colorado analysis if the bridge railing designs are significantly different. In addition to the structural analysis, bridge railings must also meet the height

2
requirements, size of openings between rails for combination traffic/pedestrian rails, and the recommended rail height-to-traffic face ratio and rail-to-post offsets noted in the LRFD Bridge Specifications.

2
Our goal is to give highway agencies a greater choice of railing designs without requiring unnecessary testing and without compromising motorist safety. As more rails are tested to comply with NCHRP Report 350, the choice of tested designs will increase and there should be less need to seek acceptance for any design that has not been tested. Please call Mr. Richard Powers of my staff at (202) 366-1320 if you have any questions.

Enclosure